PATENT

Attorney Docket No. AI 304
IN THE UNITED STATE PATENT AND TRADEMARK OFFICE
In re Application of:)
Hirokazu ARAI et al.)
Serial No.: 10/649,798) Group Art Unit:1714
Filed: August 28, 2003) Examiner: COSTALES, Shurti S
For: Resin Pulley
Assistant Commissioner for Patents
Washington, DC 20231
Sir:

RULE 132 DECLARATION

I, Takeshi TSUDA do hereby declare the followings:
I am a citizen of Japan, residing at 158-4-305, Kawaraguchi, Kashiba-shi, Nara, Japan.
I graduated from Industry Course at Seikyo Senior High School in 1989.
I have been employed by Koyo Seiko Co., Ltd. and currently engaged in a research activities relating to a resin pulley at Core Technology Research Department.

I am a joint inventor of the invention disclosed and claimed in the subject application, knowing an Office Action dated July 5, 2005 was issued for the present invention noticing the claims of the subject application was rejected under 35 U.S.C. 102 and 103 as being anticipated by, and unpatentable over Asai et al. in view of Handbook of Fillers and Saeki.

Examples 1 to 3 shown below were performed by myself or under my supervision in order to establish the resin pulley as a lubricant described in the present invention comprising Fluororesin powder that average particle diameter was no more than 10 μm was by no means identical to the ones described in the prior arts, and had superior characteristics that were not

found in the prior arts.

<<Experiment 1>>

<Producing Samples>

(Sample 1)

The following components were mixed by a Henschel mixer, a mixture obtained was kneaded by a heat roll heated at 85°C into a sheet shape, and was then ground, to produce a resin composition.

Table 1

Component	Wt%
Resol type phenol resin (*1)	23
Spherical silica powder (*2)	40
Glass fiber (*3)	30
Fluororesin powder (*4)	2
Pigment, release agent, etc	5

(*1) number average molecular weight was 800

(*2) average particle diameter was 20 μm, and Mohs hardness was 7 to 8

(*3) average fiber diameter was 13 μm, and average fiber length was 250 μm

(*4) average particle diameter was 5 μm, and RUBRON® L-2 manufactured by Daikin Industries, Ltd.

In addition, the number average molecular weight of the resol type phenol resin was measured by charging a high-speed liquid chromatograph [HLC-802A manufactured by Tosoh Corporation] with TSK-Gel Column G3000H8 (×1), G2000H8 (×2), and G1000H8 (×1) as columns.

Furthermore, a metal mold of a film gate type having a cavity corresponding to the shape of the pulley main body 11 of the resin pulley 1 shown in Fig. 1 of the subject application and having a holding portion for holding the outer ring 21 of the rolling bearing 2 provided at a position, corresponding to the center of the pulley main body 11, of the cavity was prepared.

The metal mold was set in an injection molding machine and was heated at 170°C, and the resin composition was supplied to a hopper of the injection molding machine.

The outer ring 21 was set in the holding portion of the metal mold and was clamped, the resin composition melted and kneaded in the cylinder was injected into the cavity to fill the cavity therewith, was cured to mold the pulley main body 11, and was integrated with the outer ring 21.

Thereafter, an insert molded product obtained by integrating the pulley main body 11 and the outer ring 21 was taken out of the metal mold and was cooled, was then combined with the rolling element 22, the inner ring 23, the cage 24, and the covers 25 and 26 to assemble the rolling bearing 2, and the assembled rolling bearing 2 was filled with grease, thereby producing the resin pulley 1.

(Sample 2)

A resin pulley was produced in a same manner as sample 1, except using unvulcanized nitrile rubber powder (average particle diameter was no more than 840 μm) in a same quantity as fluororesin powder instead thereof. The above-mentioned Sample 2 corresponded to the Example of Asai et al.

(Sample 3)

A resin pulley was produced in a same manner as sample 1, except using silicone rubber powder (average particle diameter was no more than 9.0 μm), which was illustrated as a lubricant in Saeki et al., in a same quantity as fluororesin powder instead thereof.

<Wear resistance test>

A belt made of rubber was stretched between the resin pulley of Samples 1 to 3 and a metal pulley. The belt has an indented surface corresponding to an indented shape of a groove on the outer periphery of the pulley main body provided on its inner periphery.

After the resin pulley was continuously rotated for 24

hours under conditions of a belt tension of 882N and the number of revolutions of 9000 rpm in a dust atmosphere of a dust amount of 2 kg/m^3 and a dust flow rate of 1 m/s, the wear thickness (mm) on an inclined surface of the groove was measured. In addition, the relative wear thickness was also calculated when the wear thickness of Sample 1 was set as 1. As a dust, two kinds of dusts, such as Class 1 (particle diameter of 45 to 212 μm) and Class 8 (particle diameter of 5 to 75 μm) both determined in "Test powders and test particles" in JIS Z8901: 1995 were mixed in a weight ratio of 1:1 and employed.

Producing the samples and the wear resistance test were performed two times for each sample, respectively. With respect to the wear thickness and relative value, an average value was determined. The results are shown in Table 2.

Table 2

		First	Second	Average
(Sample 1)	Wear thickness (mm)	0.049	0.041	0.045
	relative value	1.00	1.00	1.00
(Sample 2)	Wear thickness (mm)	0.099	0.087	0.093
	relative value	2.01	2.14	2.07
(Sample 3)	Wear thickness (mm)	0.096	0.107	0.102
	relative value	1.96	2.63	2.29

From the table, when the relative wear thickness of Sample 1 was set as 1, it was determined that the relative wear thickness of Sample 2 was 2.07 and Sample 3 was 3.29. Accordingly, it was confirmed that the resin pulley of Sample 1 performed best in the wear thickness.

<<Experiment 2>>

<Producing a Sample>

(Sample 4)

A resin pulley was produced in a same manner as sample 1, except using fluororesin powder having a particle diameter of 40 μm in a same quantity as fluororesin powder having a

particle diameter of 10μm instead thereof.

<Dispersiveness test>

The resin pulley of Samples 1 and 4, the surface of the groove on the outer periphery of the pulley main body were analyzed in element using an Energy Dispersive X-ray Spectrometer (EDX, JED-2300, manufactured by JEOL, Ltd.) connected to a Scanning Electron Microscope (S-3500N, manufactured by Hitachi High-Technologies Corporation). Producing the samples and the elemental analysis was performed three times for both samples, respectively. The results of Sample 1 are shown in Figs. 1 to 3, and Sample 4 in Figs. 4 to 6.

Green dots in each Figs. indicates a position of fluorine elements. From the Figs. it was confirmed that the agglomeration of Fluororesin powder of the resin pulley of Sample 4 was found because of uneven disperse of the fluorine elements. In contrast, dispersiveness of the fluorine elements was almost even, which confirmed that the fluororesin powder of the resin pulley of Sample 1 did not agglomerate, but evenly dispersed.

<<Experiment 3>>

<Wear resistance and belt attacking property evaluation>

With respect to Samples 1 and 4, a wear resistance test was performed under the same conditions as Experiment 1. The degree of damage to the indented surface, in contact with the groove of the pulley of the belt which has been continuously rotated was observed and evaluated in the following standards. Good: hardly damaged. There are no belt attacking properties. Bad: violently damaged and not reusable. There are belt attacking properties.

Producing the samples, the wear resistance test and the belt attacking property evaluation were performed two times for each sample, respectively. With respect to the wear thickness and relative value, an average value was determined. The

results are shown in Table 3.

Table 3

		First	Second	Average
(Sample 1)	Wear thickness (mm)	0.045	0.042	0.044
	relative value	1.00	1.00	1.00
	Belt attacking properties	Good	Good	-
(Sample 4)	Wear thickness (mm)	0.063	0.060	0.062
	relative value	1.40	1.43	1.41
	Belt attacking properties	Bad	Bad	-

From the table, when the relative wear thickness of Sample 1 was set as 1, it is determined that the relative wear thickness of Sample 4 was 1.41. Accordingly, it was confirmed that the resin pulley of Sample 1 performed better in the wear thickness. Furthermore, it was also confirmed that the resin pulley of Sample 4 had a belt attacking property whereas the resin pulley of Sample 1 had no belt attacking property.

A study into these causes found that numerous indented shapes formed with worn out Fluororesin powder in agglomeration were generated on the surface of the groove, which lowered slidability of the surface of the groove and attacked the belt. Consequently, accumulated dusts in the indented shapes worn out the pulley and the belt.

<<Conclusion>>

From the results of Experiments 1 to 3, it is confirmed the resin pulley of the present invention comprising Fluororesin powder that average particle diameter of no more than 10 μm as a lubricant was by no means identical to the ones described in the each prior arts, in addition, had superior characteristics that were not found in the each prior arts.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that

these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: 26.12.2005 By: Takeshi Tsuda

Takeshi TSUDA